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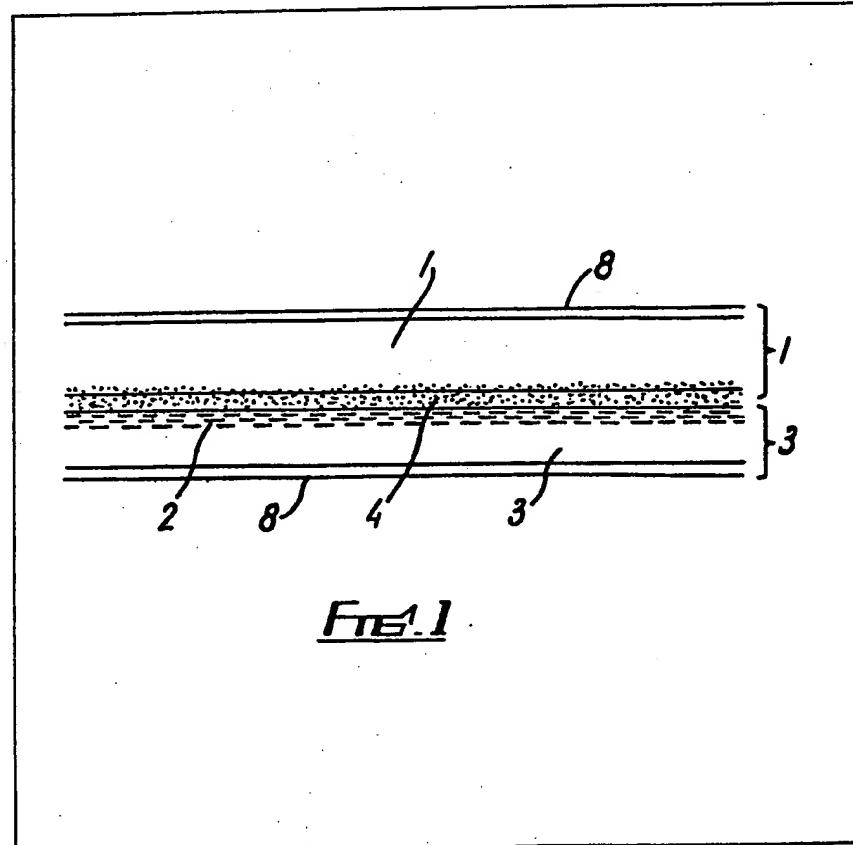
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(54) Pulp fiber structure

(57) A pulp fiber structure of the invention comprises two plies 1, 3 of pulp fibers obtained by crashing wood pulp in pieces, one of these plies 3 is treated by wetting, pressing and drying one surface to form a skin layer 2 on the ply, the two plies are put together to form a composite structure in such a manner that the skin layer 2 is sandwiched between the two plies 1, 3. A haemostatic agent 4 or a freezing mixture is placed on the skin layer 2 before the two plies are put together to provide a stauching or cooling means.



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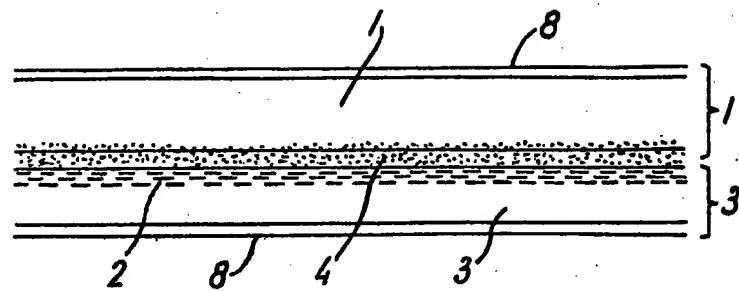


Fig. 1

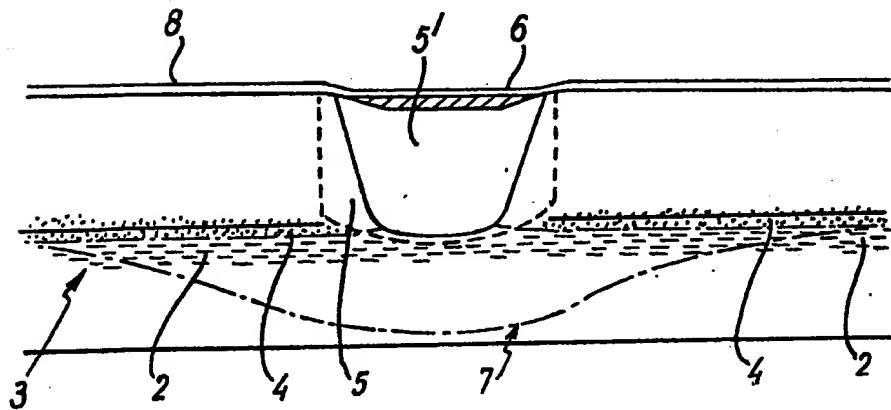


Fig. 2

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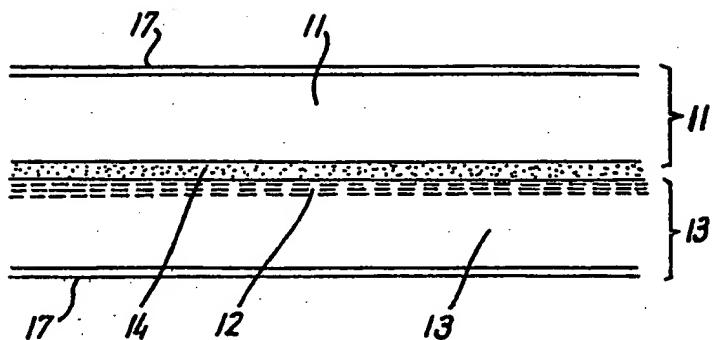


FIG. 3

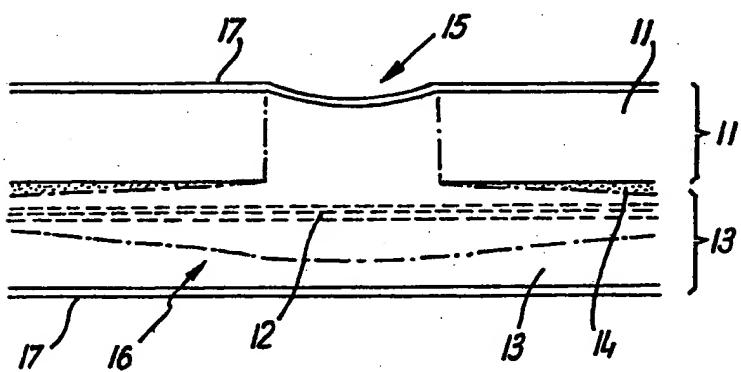


FIG. 4

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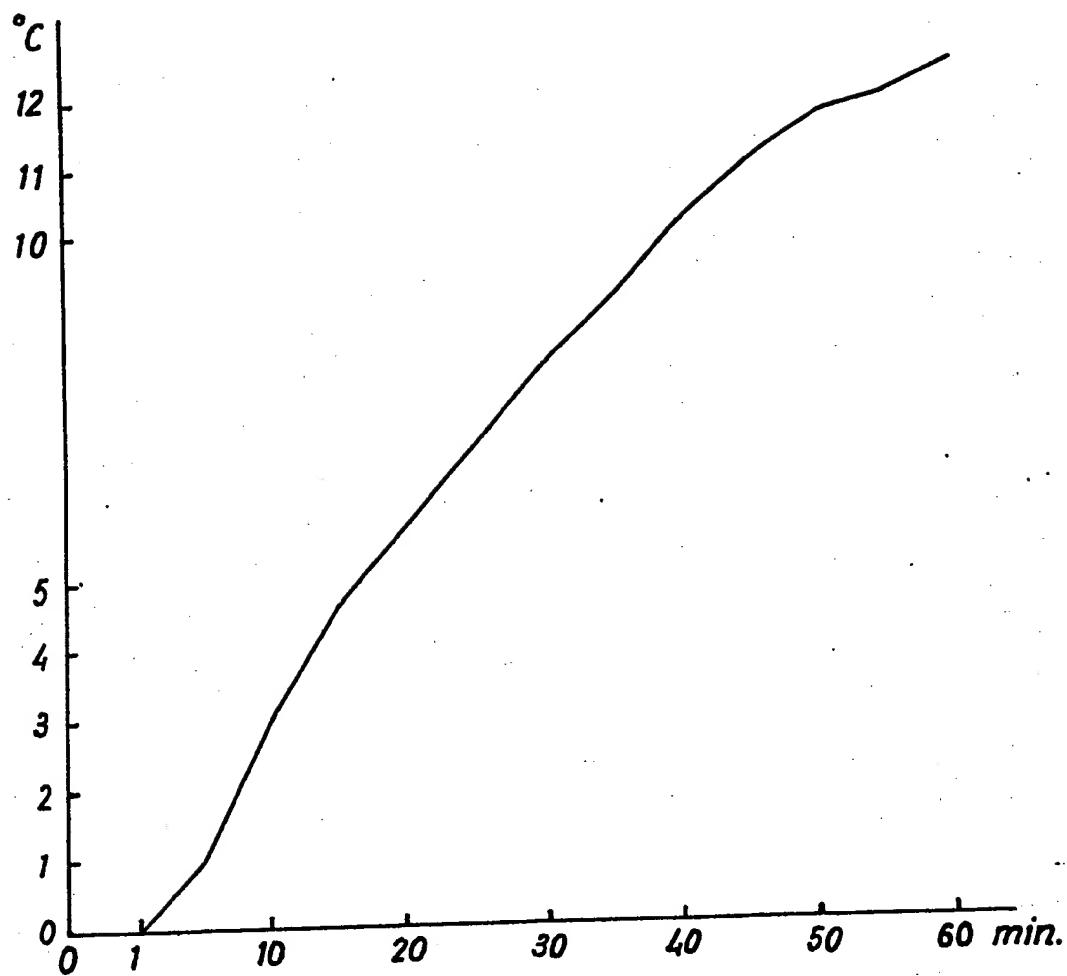


FIG. 5

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SPECIFICATION

Pulp fiber structure

5 *Background of the invention*

This invention is directed to a pulp fiber structure, and more particularly to a pulp fiber structure means for stanching or cooling purpose, said means comprising two piles of pulp fibers, the surface of one of which is treated to present a hardened skin layer on which is placed hemostatic agent or freezing mixture, these piles are combined or put together to form one structure with the skin layer continuous to remaining pile of pulp fibers placed in the middle as if sandwiched between two piles of pulp fibers.

More specifically, the invention concerns an emergency stanching means which can be placed on a wound to absorb in its own structure the flow of blood from the wound, to enable said absorbed blood to turn to a clot and then to a scab or crust which will cover the wound to stop further bleeding.

It is needless to say that treatment by a specialist is required when the flow of blood from a wound is substantial, and the wounded person may succumb to a wound due to the delay in receiving a proper treatment.

In recent years, serious injuries are seen frequently at the factories and work cities as well as in traffic accidents. On the other hand, once a severe earthquake breaks out, it is estimated that many persons will be killed or injured in big cities due to tearing down of buildings with fixtures, furniture, glasses, walls and the like broken and falling down. Telephone system for emergency calls and the road traffic would be paralysed, and the injured people cannot expect to be treated at places where they are wounded. A main object of the emergency treatment at the time and place of the injury is to hold down by stopping the flow of blood from a wound to the minimum. Bandage, antiseptic gauze, adhesive plaster and the like are used to cover the wound, but where there is a quantity of blood flow from the wound, these are of little use, and a tourniquet or a piece of cloth cut in a triangular form must be used instead to stop the bleeding. However, if a tourniquet is applied by a person unskilled in the art, nerve and/or muscle may be seriously damaged. If the flow of blood is blocked by binding an arm, for example, for more than an hour, there may be damage to the periphery, and necrosis is likely to occur as a result. Therefore, where a person is wounded resulting in substantial flow of blood, it is desired that he has an access to a stanching means which can readily be placed on the wound without any danger of inviting any one of the above-described fatal effects.

The invention concerns further a cooling means which can be placed on the wounded part of the body of a person when he receives damage such as sprain or blow from without for the purpose of suppressing swelling or extravasation before the damage becomes too difficult to be cured or causes aftereffects.

Sports are popular nowadays for the purpose of building a strong body, maintaining good health, preventing diseases or for recreation. People, young

and old, play to cut down or gain weight, or to relieve mental stress. These amateurs are inferior to the professionals in their health, strength and skill, so that they must be careful in selecting a proper game.

- 70 In addition, they should consult the doctor in advance, and pay attention to warm up their body before playing. However, many people neglect the above and play in a manner that is not proper, getting sprain or blow as a result.
- 75 Sports statistics in Japan show that cases of sprain are 33.6%, and those of blows 14.6%, of all the external injuries sustained in playing. On the other hand, grade school and junior high school children are 21%, senior high school students 31%, and housewives 48%, of all the players. Further, sprains and blows are 20 to 30% of all the injuries in each game.

With regard to the younger people, they receive injuries because, in spite of the fact that they are still weak in their physique, they do not play the right game properly. As to those who are in the middle and old age groups, their body is injured because they neglect day to day exercises as well as warming up and do not play properly.

- 90 Injuries come unexpectedly where there are not doctors or where no adequate facilities for treatment are provided. To make it worse, sprain or blow is taken lightly regardless its graveness and left without being taken care of. As a result, it takes a long time to cure the injury completely. Or, the damaged part may be deformed and the aftereffect may ensue causing inconveniences in daily life.

When a part of the human body is sprained or receives a blow, it is a matter of principle in sports medicine to soak said part in iced water or the place an ice bag filled with ice on said part. However, people seldom prepare ice water before playing. Ice is not always available where such injury is sustained. Treatment which is carried out after the injured part has swollen is not very effective. And thus, a cooling means which can easily be stored or carried and which can expeditiously applied to the injured part has long been wanted.

110 *Summary of the invention*

In view of the fact that conventional bandage, gauze or adhesive plaster has no effect in stanching the flow of blood from a wound, it is an object of the invention to offer a pulp fiber structure that can be used as a stanching means to cover a wound which causes substantial flow of blood, said means being so prepared that any person unskilled in medicine can easily apply it on the wound to stop the flow of blood without any need of other stanching means.

- 120 Such an object is accomplished according to the invention by offering an emergency stanching means which comprises two piles of pulp fibers formed by crashing wood pulps in pieces, a first pile consisting pulp fibers piled up in one layer, and a second pile also consisting pulp fibers piled up in one layer but with its one surface treated by first moistening with water, pressing said surface and then drying the same, to form a skin layer, said skin layer being continuous to remaining pile of the pulp fibers not so treated, these piles being put together

to provide one structure such that said treated surface or skin layer on which hemostatic agent has been placed is located in the middle where these piles join, these piles being finally packed in one piece by means of suitable cover means.

It is another object of the invention to offer, in view of the lack of suitable emergency cooling means to be applied to a part of the body that is sprained or hit, a cooling means that can be easily stored or carried and which can be readily applied to the injured part of the body to effect chilling of said part.

According to the invention, said object can be accomplished by offering a cooling means comprising two piles of pulp fibers obtained by crashing wood pulps in pieces, a first pile consisting pulp fibers piled in one layer, and a second pile consisting also pulp fibers piled up on one layer but with its one surface treated by first moistening with water, pressing said surface and then drying the same to form a skin layer, said skin layer being continuous to the remaining the pulp fibers not so treated, these piles being put together such that said treated skin layer on which suitable freezing mixture has been placed is located in the middle where these piles join, these piles being finally packed in one piece by means of suitable cover means. In use, the package is broken, and water is added to said pile to bring about the cooling effect, and the means is used like a wet compress.

30 The above and further objects and novel features of the invention will appear more fully from the following detailed description when read in conjunction with accompanying drawings. It is to be expressly understood, however, that the drawings are 35 not intended as a definition of the invention but are for the purpose of illustration only.

Brief description of the drawings

In the drawings:

40 *Figure 1* is a cross-sectional view of a stanching means according to the invention,

Figure 2 is a view similar to that of *Figure 1*, illustrating the coagulation of blood,

45 *Figure 3* is a cross-sectional view of a cooling means according to the invention,

Figure 4 is a view similar to that of *Figure 3*, illustrating how added water is absorbed and retained by the structure of the cooling means, and

50 *Figure 5* is a graphic diagram illustrating the change of temperature of the cooling means relative to the lapse of time.

Description of the preferred embodiment

It may be useful to explain the features of pulp fiber pile and its effect to stop the flow of blood before fully describing a preferred embodiment of the invention.

Where a pile of pulp fibers is formed, the pile does not exhibit effective capillary action. Thus, liquid (blood in case of the present invention) absorbed by the pile is retained only at or near where the pile is in contact with said liquid, and liquid is not dispersed or spread out to surrounding dry portions of the pile. If the pile keeps contact with liquid further, only one 65 part of the pile will be saturated with said liquid.

When blood flows from a wound, as is generally known, fibrinogen in blood plasma turns to insoluble fibrin which tends to confine blood corpuscles, making blood viscous. Blood then turns to clot which 70 in turn changes to scab or crust which stops the flow of blood.

Blood consists 55% blood plasma and 45% corpuscles. That which brings about coagulation of blood is fibrin in blood plasma and corpuscles, and serum 75 has nothing to do with coagulation of blood. When a large quantity of blood flows from a wound, the amount of serum increases at a rate larger than the increase of fibrin, and this increase of serum hinders checking of bleeding. In other words, serum obstructs coagulation of blood. With this basic understanding, an embodiment of the invention will now be described, reference being made to the accompanying drawings.

There is shown in *Figure 1* in cross-section a 85 stanching means according to the invention, the means comprising a first pile of pulp fibers and a second pile of pulp fibers which is formed with a skin layer continuous to the remaining pulp fibers in the interior, with pulverized hemostatic agent placed in 90 the middle where these two piles join.

In *Figure 1*, reference numeral 1 denotes a first pile of pulp fibers, 2 a skin layer, 3 a second pile of pulp fibers having the skin layer 2, 4 pulverized hemostatic agent, 8 an exterior cover. The first pulp fiber pile 95 1 and the second pulp fiber pile 3 having the skin layer 2 are put together with hemostatic agent 4 sandwiched therebetween. An adhesive tape or cloth, not shown, is placed on the lower cover 8 before the stanching means is marketed.

100 *Figure 2* shows in cross-section the following process: blood is locally absorbed, next saturated, then makes contact with the hemostatic agent placed in the middle of the stanching means, then tends to coagulate, and further, serum in blood

105 permeates into the skin layer 2 and dispersed in said skin layer 2, with coagulation synergically accelerated in the above process to form a clot which then turns to a scab or crust. In this *Figure 2*, an area 5 enclosed by a dotted line shows the part that is

110 saturated with blood (the part will be referred to as saturated part hereafter), area 5' a blood clot, and a shaded part 6 a scab, an area enclosed by a chain line a part wherein serum dispersed. In use, the upper cover 8 of *Figure 1* makes contact with a

115 wound.

Referring again to *Figure 2*, when the stanching means of *Figure 1* is applied to a wound, blood flowing through the cover 8 is locally absorbed by the first pulp fiber pile 1. In said pulp fiber pile, there 120 will be no permeation or spreading out of blood to the unwetted part of the pile. Thus, if absorption of blood continues, saturated part 5 is formed locally, then blood makes contact with the hemostatic agent 4 located in the middle part of the stanching means.

125 A suitable hemostatic agent to be used in the stanching means shown in *Figure 2* is the Japanese Pharmacopoeia tropine. The saturated part 5 also makes contact with the skin layer 2. The skin layer 2 shows positive capillary action since it has been

130 treated as described before (wetting, pressing and

drying), so that serum in the blood is spread out to unwetted portion as illustrated by the reference numeral 7 in Figure 2. Because of this, the amount of serum which obstructs coagulation of blood decreases in the saturated part 5, which helps acceleration of coagulation and formation of the clot 5'.

The blood clot 5' formed to extend from pulp fiber pile 1 to the skin layer 2 is deprived of the remaining serum, and the clot 5' shrinks gradually. Scab 6 is formed at periphery of clot 5', and the flow of blood is stopped when the scab covers the wound.

The stanching means described so far has a simple structure. In use, it is placed on a wounded part, and its sides are fixed by means of adhesive tapes not shown. The flow of blood is halted without using a tourniquet or the like.

Another embodiment of the invention which is a cooling means is shown in cross-section in Figure 3 in which 11 denotes a first pile of pulp fibers, 12 a skin layer, 13 a second pile of pulp fibers having the skin layer 12, 14 freezing mixture and 17 a cover. The first pulp fiber pile 11 and the second pulp fiber pile 13 having the skin layer 12 is put together to sandwich the freezing mixture 14 therebetween. An adhesive tape or cloth, not shown, is placed on the cover 17.

Figure 4 is a cross-sectional view of the cooling means of Figure 3 to illustrate what happens when water is added. Water is added from above the cooling means as seen in Figure 2. Thereafter, the following were observed: water is retained by the first pulp fiber pile 11, then the part of said pile retaining water is saturated with water. (This part will be referred to as the saturated part hereinafter.) Water in the saturated part then makes contact with the freezing mixture which acts to exert cooling effect after dissolution. Water then permeates into the skin layer spreading out laterally or horizontally as seen in the drawing, making further contacts with freezing mixture successively and consequently bringing about cooling actions of the dissolved agent. In Figure 4, reference numeral 15 represents the part where water is added, area 16 enclosed by a chain line a part where water has spread and caused dissolution of the freezing mixture. In use, water is added to the upper cover as seen in the drawing, and this upper cover makes contact with a part to be cooled.

Referring again to Figure 4, water is absorbed by the pulp fiber pile 11 through the cover 17. Said pulp fiber pile shows little capillary action by itself, so that absorbed water is retained locally at or near where it was added without spreading out. When more water is added, this part will be saturated with water. However, the skin layer 12 of the pulp fiber pile 13 shows positive capillary action due to the treatment given to it, so that water reaching the skin layer is spread out laterally or horizontally.

With the cooling means of Figure 4 having an area of 90 to 100 cm², for example, suitable amount of water, for example 20 to 30 g, if poured on the cover 17 over the part 15. A part of the pulp fiber pile 11 becomes saturated with water locally. Water then makes contact with the freezing mixture 14 placed in the middle of the cooling means, dissolve the

mixture to bring about a cooling action. Water permeates the skin layer 12 laterally to make further contacts with the freezing mixture 14 successively, causing more cooling actions to enhance the cooling effect of the cooling means.

The freezing mixture described above is a mixture which exhibits cooling effect when dissolved in water. Such mixture can be handled easily, and it is cheap. In the described embodiment, sodium carbonate (Na₂CO₃) and ammonium chloride (NH₄Cl) were mixed at a rate of 1:1.5. The cooling effect of such a mixture is shown in Figure 5.

In a graphic representation of Figure 5, the abscissa shows the passage of time from a point when 80 water is added to the cooling means of the invention, the ordinate the temperature of the part of the cooling means in contact with a part of human skin that was injured. When water was added, the temperature of part 15 of the cooling means was 0°C. 85 When the part 15 is placed on the injured part, the part 15 is warmed by the said part of which temperature would be slightly higher than the vital warmth. As time passes, the temperature of the part 15 goes up as illustrated in Figure 5, showing 8°C 90 after lapse of 30 minutes, 12.5°C when one hour lapsed. This would show that the injured part is sufficiently cooled for one hour. As an injured person would be treated by a doctor within one hour from the time he was injured under normal circumstances, Figure 5 shows that an emergency cooling treatment required under the principle of the sports medicine is effectively carried out when the cooling means of the invention is used.

However, if water in excess of 30g is added, more 100 water permeates and is spread in the skin layer, bringing about more dissolution of the freezing mixture. Although cooling effect is increased, time during which cooling is effective will be shortened accordingly.

105 As will be understood from the foregoing, the structure according to the invention becomes a cooling means by simply adding water to it. It can then be placed on the part of the body sprained or hit, and then can be fixed in position by an adhesive 110 tape, not shown. It will then prevent swelling of the body and extravasation. Its structure is simple, and it can be stored and/or carried handily. It can be applied easily. Because of these, the cooling means of the invention is suitable as an emergency aid. In 115 the foregoing, the invention has been described by reference to people playing, but the means of the invention can also be used in other cases. Where a patient's head must be cooled at a place where there is no ice, the means of the invention can be used 120 instead of an ice bag. Or, it may be used on the body of a pet or a racing horse.

Thus, the invention having been described in its best embodiment and mode of operation, that which is desired to be protected by Letters Patent is:

125 CLAIMS

1. A pulp fiber structure which comprises a first pile of pulp fibers obtained by crashing wood pulp in 130 pieces and a second pile of pulp fibers of the same

kind of which one surface is treated by wetting, pressing and drying to form a skin layer which is continuous to the remaining pile of pulp fibers, said two piles of pulp fibers are put together to form a
5 one piece structure with said skin layer interposed between said piles of pulp fibers.

2. A staunching means according to claim 1 wherein hemostatic agent is placed on said skin layer before said piles are put together.
- 10 3. A cooling means according to claim 1 wherein freezing mixture is placed on said skin layer before said piles are put together.
4. A pulp fiber structure substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 5 of the accompanying drawings.
- 15 5. A staunching means substantially as hereinbefore described with reference to and as illustrated in Figures 1 and 2 of the accompanying drawings.
6. A cooling means substantially as hereinbefore described with reference to and as illustrated in Figures 3 to 5 of the accompanying drawings.

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